The Performance of Plants Inserted in Global Supply Chains: A Look at Vertically-Linked Affiliates

Blyde, Juan and Santamaria, Julieth

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Juan Blyde[♦]
Inter-American Development Bank

Julieth Santamaria
Inter-American Development Bank

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ABSTRACT

An increasing number of case studies provide evidence that the interaction between global actors and firms in developing countries, particularly within the context of global supply chains, translate into critical knowledge acquisition. Examining vertically-integrated affiliates located in Chile we provide systematic evidence showing that foreign affiliates inserted in global supply chains tend to have larger capabilities in terms of size, skills and productivity, are more export oriented, and produce goods of higher quality, as measured by unit values, than other exporters in the country. We show that the superiority of these establishments increase with the age of the multinational indicating that time is required to accumulate the necessary skills. We also show that the edge of foreign affiliates in terms of the export outcomes decreases but does not disappear completely after these differences in plant capabilities are controlled for, a result that suggests that additional factors, most likely of intangible nature, might be behind the improved export performance and higher quality of goods of these establishments.

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[♦] Correspondence address: Juan Blyde. Inter-American Development Bank, 1300 New York Ave., NW, Washington DC, 20755, U.S. Phone: (202) 623-3517, Fax (202) 623-2995. E-mail: juanbl@iadb.

1 Introduction

Production processes have been increasingly fragmented worldwide. That is, the making of many goods has become a multi-country process in which different stages are carried out in specialized plants in different parts of the world. Many developing countries are seeking to join international production networks for various reasons. For instance, participation in international supply chains is frequently associated with rapid learning, technology transfers and knowledge spillovers. A literature on global value chains has emphasized the idea that suppliers in production networks are exposed to learning and knowledge acquisition emanating from lead firms (Humphrey and Schmitz, 2002; Schmitz and Knorringa, 2000, Schmitz, 2006). Lead firms are generally willing to transfer knowledge to their suppliers because failing to do so might entail risks for themselves. For instance, the arrival of a component with the incorrect specifications can have quite disrupted impacts in the production of a final good as entire production lines might be shut down until all the correct inputs have been gathered. Accordingly, lead firms expose their suppliers to quality control systems and prevailing global business standards that tend to exceed those in developing countries. By being "pushed" to possess or acquire higher competencies these suppliers tend to produce goods of higher quality than other firms in their countries.

There have been an increasing number of case studies showing that access to a global production network is indeed associated with critical acquisition of capabilities and high quality goods. Analyses can be found in many sectors, like in apparel (Gereffi, 1999), motorcycle (Fujita, 2011), the agroindustry (Cafaggi, et al., 2012) or the computer industry (Kawakami, 2011). But more systematic evidence showing that participation in production networks is associated with superior competencies and higher quality goods is still missing. This paper seeks to fill this gap in the literature.

In this study we combine a detailed dataset of multinational companies with plant level data from Chile to compare the performance of vertically-integrated affiliates with that of local plants. If suppliers in global production networks are required to possess superior capabilities in order to successfully perform in value chains, this should be particularly true when the supplier is an affiliate of a multinational company. Accordingly, we examine whether vertically-integrated affiliates located in Chile exhibit an edge over other exporters in the country in a number of export outcomes and firm characteristics.

It is worth noting that vertical FDI is not the only strategy that production processes can be offshored. Lead firms fragmenting production internationally can open affiliates in other countries but they can also engage in foreign outsourcing with independent suppliers if they decide to keep offshoring outside the boundaries of the firm. Admittedly, this could represent a problem for our exercise because our control group could in principle include local independent suppliers that participate in international production networks and as

mentioned above, these suppliers could be exposed to higher quality controls and business standards in similar ways as the affiliates of multinationals. Ideally we would like to separate this type of establishments from the control group; unfortunately we do not have the required information to do so. Keeping these plants in the sample could bias the results, but if anything, the direction of the bias should be against the likelihood of finding a superior performance of the vertically-integrated affiliates over the control group.

The results show that even within narrowly defined sectors, vertically-integrated affiliates tend to be bigger, exhibit larger shares of skilled workers and have larger productivity levels than the rest of the exporters. The results also show that these firms are superior in terms of total exports as well as the number of products exported and have larger export unit values than the other exporters. The findings go in line with increasing evidence from case studies in the global value chain literature that participation in production networks is associated with improved capabilities and higher quality of the goods.

The paper is also related to a more general FDI literature showing that foreign affiliates have better performance than local counterparts. For instance, Barefoot and Mataloni (2011) present evidence for the US suggesting that labor productivity in the manufacturing sector is higher among multinational parents than among non-multinationals. Similarly, Mayer and Ottaviano (2007) provide evidence for Belgium, France, Germany and Norway indicating that multinational parents are generally bigger, more productive and pay higher wages than firms that are not engaged in multinational activity. More related to our paper, there is an important literature showing that foreign affiliates tend to perform better than the local plants in their host countries. For instance, higher productivity levels in foreign affiliates relative to domestic plants has been found for various countries including Venezuela (Aitken and Harrison, 1999), Lithuania (Javorcik, 2004), the Czech Republic (Sabirianova et al., 2005) and Turkey (Yasar and Paul, 2007). Antras and Yeaple (2013) show evidence for a group of OECD countries that affiliates of multinationals tend to be larger, more productive, more R&D intensive and more export oriented than local firms. Arnold and Javorcik (2009) found that the acquisition of local plants by multinationals in Indonesia led to significant productivity improvements in the acquired plants.

Our paper is specially related to a stream of the FDI literature that has found empirical support to the notion that FDI may promote upgrading and higher quality of export products. For example, using firm level data for Mexico, Iacovone and Javorcik (2008) show that unit values of new export products introduced by foreign firms are larger than those of domestic producers. Similarly, Wang and Wei (2008) show that multinationals in China have systematically higher unit values than local firms, suggesting they produce higher-end products. Finally, using a cross-country analysis, Harding and Javorcik (2012) show that more FDI presence is positively correlated with higher unit values of exports.

Our results complement this literature in various ways. First, as we focus on vertically-linked affiliates, we are the first study to explicitly examine the functioning of multinationals relative to local firms in the context of global supply chains. Second, we provide additional insights regarding the improved performance of these multinationals. For instance, we investigate whether there are dynamics in the enhanced performance of affiliates over the local plants. Our results indicate that in general the gaps increases with the age of the multinational, suggesting that certain skills and capabilities tend to be accumulated only over the years. Second, we also show that the superiority of foreign affiliates in terms of export outcomes decreases but does not disappear completely after differences in plant capabilities, like size, productivity and skills, are controlled for. This last result indicate that well defined plant capacities play an important role behind the improved outcomes of the foreign affiliates but that there might also be other contributing factors, most likely of intangible nature.

The rest of this paper is organized as follows. In sector 2 we describe the datasets, basic patterns in the data and the empirical estimation that we conduct. Section 3 shows the results of the estimation and discusses the most salient findings. Finally, section 4 concludes.

2 Data description and basic patterns

We merge three datasets in our analysis. First we employ a worldwide dataset of multinationals, the Worldbase dataset from Dun & Bradstreet (D&B).[1] For each establishment in this dataset, there is information on an array of variables, including: country and city of location, industry codes and ownership (the firm's parents). From this dataset we choose the affiliates located in Chile that exhibit corporate linkages[2] with multinationals in other countries. In addition, we follow Alfaro and Charlton (2009) in identifying whether the relationship between the affiliate and its parent company is horizontal (the parent and the subsidiary produce the same good), vertical (the subsidiary produces an input to the parent) or complex (the relationship is both horizontal and vertical). The methodology essentially entails comparing the industry codes (at the 4-digit SIC level) of both parents and subsidiaries to examine whether they produce the same good and/or whether the subsidiary is a supplier to its parent. The latter is determined using the industry

[1] The data have also been used in academic studies for various purposes including the comparison of size and diversification patterns of foreign investment in North America (Caves, 1975), the development of microdatasets on enterprises (Lipsey, 1978), the effect of bank credit availability and business creation (Black and Strahan, 2002), the relationship between financial development and vertical integration (Acemoglu, Johnson and Mitton, 2009), the patterns of intra-industry and inter-industry FDI (Alfaro and Charlton, 2009) and the relationship between foreign ownership and establishment performance (Alfaro and Chen, 2011).

[2] A corporate linkage occurs when one business location has financial and legal responsibility for another business location. In the D&B dataset a corporate linkage occurs between a subsidiary and its parent or between a branch and its headquarter. A subsidiary is a corporation that is more than 50% owned by another corporation. A parent is a corporation that owns more than 50% of another corporation. A headquarter is a business establishment that has branches reporting to it, and is financially responsible for those branches. A branch is a secondary location of its headquarters and it has no legal responsibility for its debts. There are other types of family relationships that may occur between companies which are not linked in the D&B dataset because the relationship does not involve legal or financial responsibility. For instance, one company owns a part or minority interest, less than 50%, in another company or joint ventures where there is a 50/50 split in the ownership.

codes in combination with an input-output table to identify whether the industry of the subsidiary corresponds to an upstream industry of the parent's output. Similarly to Alfaro and Charlton (2009) we use the Bureau of Economic Analysis 1987 benchmark input-output table and employ alternative thresholds of the input-output total requirements coefficient.[3] In this paper we work only with the affiliates that are vertically-linked to a firm in another country which are identified at the 4-digit SIC level.

The second dataset consists on transaction-level data from the Chilean national customs authority –*Servicio National de Aduana*- for all the manufacturing firms. Trade transactions in this dataset are identified at the 8-digit HS level and each record includes a firm identifier, the destination country, the export value of the transaction as well as its unit value in US dollars. These data provides the basis for comparing unit values and other export performance indicators across establishments. Finally, we employ plant-level data from the annual manufacturing survey ENIA (*Encuesta Nacional Industrial Annual*) conducted by the national institute of statistics, INE. The survey covers all manufacturing establishments in the country with more than 10 employees and provides information on plant characteristics, such as manufacturing industry (4-digit ISIC rev3), production, employment, and investment. Capital stocks are constructed using the perpetual inventory method for each plant (see Liu, 1993) and a measure of the plant's total factor productivity is constructed using multifactor superlative index number as in Bernard, Jensen and Schott (2006). Using this manufacturing survey allows us to compare vertically-linked affiliates with the other plants in terms of various firm characteristics.

The combination of these three datasets gives us a rich amount of information to perform the various comparisons of this study. The ENIA survey encompasses an average of 5,400 plants per year and from this group around 1,400 plants are exporters. We can analyze in detail the export transactions of these 1,400 plants after merging the ENIA survey with the customs data. Using the Worldbase dataset we identify from this group of exporters 73 plants that are vertically-linked to multinationals in other countries. We compare these 73 plants against the other exporters in terms of a number of characteristics and export outcomes. Our data is available for the 1997-2006 period.

Table 1 provides a preliminary comparison between the vertically-linked affiliates and the rests of the exporters across various export outcomes. On average, vertically-linked affiliates sell abroad 12.1 products for 60.4 million US dollars while the corresponding figures for the other exporters is 7.8 products for 16.4 million US dollars. When we look at the unit values of exports, the comparison provides mixed results. In terms of average, affiliates exhibit lower unit values than the rest of the exporters while the opposite is true when median values are used.

[3] Specifically, we employ a baseline threshold equal to 0.001. See Blyde and Molina (2013) for a discussion on the use of thresholds.

While informative, the results in table 1 are only rough approximations of the true differences between these two groups of plants. The values in table 1 are averages across different products and across establishments in different sectors. A proper exercise must compare total export values and total number of products across firms in similar sectors, and unit values across similar types of goods. To this end we run the following specifications:

$$Y_{ikt} = \theta + \beta V_i + D_k + D_t + \varepsilon_{ikt} \quad (1)$$

where Y_{ikt} is either the log of the total value of exports or the log of the total number of products that plant *i* in sector *k* exports in year *t*, V_i is a dummy variable that takes the value of 1 if the plant is a vertically-linked affiliate and zero otherwise, and D_k and D_t are sector and year fixed effects, respectively. The sector in this specification is defined at the 4-digit ISIC rev 3 level. If foreign affiliates exhibit enhanced outcomes over the rest of the exporters, we should expect a positive and significant coefficient for β.

Additionally, we run the following specification for the unit values:

$$UV_{ipct} = \theta + \beta V_i + D_p + D_c + D_t + \varepsilon_{ipct} \quad (2)$$

where UV_{ipct} is the log of the unit value of the export of good *p* by plant *i* to destination country *c* in year *t*, D_p, D_c and D_t are product, destination country and year fixed effects, respectively, and V_i is defined as before. The product in this specification is at the 8-digit HS level. The specification takes in consideration that unit values might differ across firms, products, years and destination country. By using the dataset at this level of disaggregation we avoid having to work with average unit values across any of these dimensions.

3 Econometric results

Table 2 shows the results after estimating equation (1) for the total value of exports and the total number of products. The results in columns (1) and (3) reveal the stronger export performance of the vertically-linked affiliates over the rest of the exporters. Foreign affiliates export around 4 times more ($e^{1.6} - 1 = 3.9$) and sell abroad about 54% ($e^{0.43} - 1 = 0.54$) more products than the other exporters. The results in columns (2) and (4) in which we control for possible changes in sector characteristics across time using sector-year fixed effects, confirm these findings.

The comparison for unit values is shown in table 3. Column (1) of this table presents the baseline specification introduced in equation (2). Columns (2)-(4) run alternative combinations of fixed effects to examine whether the results change in any significant way. The coefficient estimate for the dummy on vertical affiliate is positive and significant at 1% level in all the regressions and the coefficients seem to be very stable

across the various specifications. Exports of vertical affiliates exhibit unit values that are on average 8% higher than the unit values of the rest of the exporters, suggesting that foreign affiliates tent to export higher quality goods.

One issue of potential concern is the possibility that multinationals are engaging in transfer pricing, the practice of adjusting charges among related parties to take advantages of differences in tax systems and/or import duties across locations. Evidence supporting the existence of transfer pricing is shown in Swenson (2001), Clausing (2003) and Bernard, Jensen and Schott (2006). It is possible then the unit values of the exports that are sent from the affiliate to its parent company or to other plants that belong the multinational's family are affected by transfer pricing practices. Unfortunately we do not have a direct way to control for this factor. What we do in this paper, however, is to test whether the edge that we observe in unit values from the affiliates is still present when we examine only the exports that they sell in countries outside the multinational's network. We argue that if the edge is still present, it is not very likely that transfer pricing activities are the driving factor behind the higher unit values that we observe in the initial results.

We employ the Worldbase dataset to identify for each vertically-linked foreign affiliate in Chile the country of its parent as well as the countries in which its parent has other affiliates. Then, we re-calculate the unit values of the foreign affiliate by using only the exports that do not go to any of these countries. The control group remains the same as before. Columns (5)-(8) show the results. While the coefficient estimates vary slightly from the previous regressions they remain positive and significant at conventional levels suggesting that the higher unit values of the exports of foreign affiliates are not likely to be driven by transfer pricing activities.

Beyond export outcomes, we also want to analyze whether vertically-linked affiliates show superior performance in terms of certain firm characteristics. Table 4 shows this exercise. The first panel compares the foreign affiliates with all the establishments of the ENIA which includes the exporters and the non-exporters of the survey. The results show that the foreign affiliates tend to be bigger, exhibit larger shares of skilled workers and possess higher levels of total factor productivity than the rest of the plants. The middle panel shows that the favorable comparison remains when the control group consists only on the exporters of the sample, while the bottom panel shows that the superiority is particularly large with respects to the non-exporters. In short, exporters exhibit larger capabilities than non-exporters and foreign affiliates exhibit larger capabilities than the exporters.

Now we would like to examine whether there are some dynamics in the superiority of the foreign affiliates. In section 1 we argue that the suppliers in global supply chains are typically pushed to acquire enhanced capabilities in order to successfully perform in international production networks. While the results in table 4 certainly provide evidence that vertically-linked foreign affiliates exhibit higher capabilities relative to other

plants, it is unclear whether this edge is present from the start or whether it is accumulated over time. To explore this issue we augment equation (1) in the following way:

$$Y_{ikt} = \theta + \beta_1 V_i^1 + \beta_2 V_i^2 + \beta_3 V_i^3 + D_k + D_t + \varepsilon_{ikt} \quad (3)$$

where V_i^1 is equal to 1 if the plant is a vertically-linked affiliate and is less than 5 years old; V_i^2 is equal to 1 if the plant is a vertically-linked affiliate and is between 5 and 15 years old, and V_i^3 is equal to 1 if the plant is a vertically-linked affiliate and is older than 15 years. With this specification we employ age cohorts in order to separate the life cycle of the affiliates in reasonable groups: young (up to 5 years), mid-age (between 6 and 15) and mature (more than 15), and then check whether the superiority of the affiliate changes across these cohorts.[4] The results for size, share of skilled labor and productivity are shown in figure 1 which plots the estimates of β_1 , β_2 and β_3 for each of the regressions.[5]

The first aspect to notice in the three graphs is that the estimated coefficient is already positive and significant in the first cohort. In principle, this would suggest that foreign affiliates exhibit better capabilities from the start. However, a word of caution is in order here. While we can establish the age of the affiliate because we know the year it was founded, it is certainly possible that the plant would have started operations before that year, for instance, as an independent firm. Since we do not have a way to know whether this is the case or not, we will not want to jump into any conclusion with respect to this particular result. Rather than focusing on the point estimate of the first cohort, we will focus on the entire trend.

In general, the trends suggest that the superior capabilities of the foreign affiliates increase with time. The graphs show that the gaps in terms of size, skills and productivity that the mature affiliates exhibit relative to the control group are larger than the gaps that the young affiliates exhibit relative to the same group.

Figure 2 show the results for the various export outcomes. The three graphs in the first column depict the results when we employ all the exports of the foreign affiliate while the three graphs of the second column present the results when only the exports of the affiliate to the countries outside its network are considered.

In general, the trends indicate that the better performance of the foreign affiliates in terms of total exports and the number of products increase with time. Interestingly, this does not seem to be the case for unit values which remain roughly the same between the first two cohorts and then decline in the third cohort. The comparison between the dynamics observed between the unit values in figure 2 and the variables in figure 1 indicate that the edge of affiliates in terms of firm's capabilities increases over time while the edge in terms of

[4] We also employ slightly different cohorts and the results do not change in any significant way

[5] If a coefficient is not statistically significant at 10% level it is plotted with a zero value regardless of its estimated value in the regression

the quality of the goods does not. This could suggest that the firm capabilities that we are examining (size, skills and productivity) might not be the only factors behind the better export performance that foreign affiliates exhibit, particularly for unit values. We take a closer look at this issue next.

First, we run the same regressions as in table 2 but controlling for differences in size, skills and productivity. The idea is to see whether differences in these capabilities are behind the better performance of the affiliates in the various export outcomes and whether controlling them eliminates the gaps originally found in the export outcomes. The results are reported in table 5 which again depicts regressions when all the exports of the affiliates are employed (columns 1 to 4) and when only the exports to the countries outside the affiliate's network are considered. A direct comparison of the coefficients for the dummy variable in columns (1) to (4) with the ones in table 2 shows that all the estimates decrease considerably, around half of the original estimates. This already indicates that the capabilities included in the regression play a role in the enhanced export outcomes of the affiliates. Interestingly, however, all the estimates are still positive and significant, suggesting that there might be still other factors besides those controlled by these firm characteristics that could be behind the edge of the foreign affiliates. Note also that the coefficients for the dummy variable in the regressions for the number of products when the affiliate export to the countries outside its network (columns 7 and 8) are not statistically significant. The result suggests that for this particular export outcome, the differences in the capabilities examined in these regressions account entirely for superiority of the foreign affiliate.

Table 6 presents a similar exercise for the unit values. The results from this table can be compared to those in table 3. Once again the estimates decline in all the regressions but they are still positive and significant at conventional levels, suggesting that there might be still other factors behind the higher quality of goods produced by foreign affiliates.

Finally, we re-estimate an augmented version of equation (3) in which the labor, skills and productivity variables are also included in the regression. Figure 3 shows the point estimates of β_1 , β_2 and β_3 for the various export outcomes. For comparison, we also include the original point estimates that we presented in figure 2. Because the new point estimates are always smaller than the original ones, it is clear again that these firm characteristics play an important role in the superiority of the foreign affiliates over the control group, particularly for exports and number of products and less so for unit values. It is also clear that these capabilities do not account completely for the gaps observed because most of the point estimates continue to be statistically significant. The fact that concrete measures of plant's characteristics like size, skills or productivity do not exhaust the possible explanations behind the better export outcomes of the foreign affiliates suggests that other aspects, perhaps more intangible in nature, could be playing additional roles. For instance, information barriers can be an important obstacle behind export activities (Rauch, 1996, 1999).

These barriers might be less severe for a multinational group with a large capacity to gather tacit knowledge and exchange it through its various production units than for a single plant. Exploring in detail the role of this or other potential factors would be an interesting project for further research.

4 Conclusions

A recent literature on global value chains have emphasized the idea that the interaction between global actors and firms in developing countries, particularly within the context of global supply chains, is likely to translate into critical knowledge acquisition. An increasing number of case studies support the notion that lead firms tend to expose their suppliers to high quality control systems and technical standards and as a result they produce goods of higher quality than other firms in the country. But more systematic evidence was still lacking.

In this study we compare vertically-integrated affiliates located in Chile with other exporters in the country to examine whether participation in production networks is correlated with better performance outcomes. We show that vertically-integrated affiliates are bigger, exhibit larger shares of skilled workers, have higher productivity levels, export more and produce goods of higher quality, as measured by unit values, than the rest of the plants. Our results also indicate that the improved capabilities of foreign affiliates do not arise overnight. In general, the gaps between the foreign affiliate and the local plants increase with the age of the multinational, suggesting that superior skills and capabilities require time to accumulate.

We also show that the superiority of foreign affiliates in terms of export outcomes decreases but does not disappear completely after differences in plant capabilities, like size, productivity and skills, are controlled for, a result that suggests that additional factors, most likely of intangible nature like lower information barriers, might behind the enhanced export performance and higher quality of goods of foreign affiliates.

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Table 1: Descriptive statistics. Average values for the period 1997-2006

	Vertically-linked affiliates		Other exporters	
Variable \ Statistics	**Mean**	**Median**	**Mean**	**Median**
Exports	60,411.64	2,301.79	16,410.42	398.00
Number of products	12.11	6.35	7.78	4.21
Unit value	2,860.41	37.67	6,913.79	12.01

Notes: the sample includes 1452 firms of which 73 are vertically-linked affiliates and 1379 are other exporters. Exports and unit vales are expressed in thousands of US dollars and US dollars respectivelly

Table 2: Regressions on total exports and number of products

	Exports		Number of products	
	(1)	**(2)**	**(3)**	**(4)**
Dummy vertical affiliate	1.6159***	1.5998***	0.4386***	0.4298***
	(0.1197)	(0.1245)	(0.0498)	(0.0515)
Sector fixed effect	yes	no	yes	no
Year fixed effect	yes	no	yes	no
Sector-year fixed effect	no	yes	no	yes
Observations	8000	8000	8002	8002
R^2	0.30	0.34	0.14	0.19

Notes: The dependent variable in columns (1) and (2) is the log of exports at the firm, sector and year level; the dependent variable in columns (3) and (4). Sector is defined at the 4-digit ISIC rev3 level.

*** ; ** ; * significant at the 1%, 5% and 10% level respectively

Table 3: Regressions on unit values

	To all countries				To countries outside the network			
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Dummy vertical affiliate	0.0809***	0.0648***	0.0962***	0.0884***	0.0484***	0.0612***	0.0713***	0.0996***
	(0.0125)	(0.0134)	(0.0117)	(0.0142)	(0.0145)	(0.0157)	(0.0134)	(0.0162)
Product fixed effect	yes	no	no	no	yes	no	no	no
Country fixed effect	yes	no	no	no	yes	no	no	no
Year fixed effect	yes	yes	no	no	yes	yes	no	no
Product-country fixed effect	no	yes	no	no	no	yes	no	no
Product-year fixed effect	no	no	yes	no	no	no	yes	no
Country-year fixed effect	no	no	yes	no	no	no	yes	no
Product-country-year fixed effect	no	no	no	yes	no	no	no	yes
Observations	186723	186723	186723	186723	181708	181708	181708	181708
R^2	0.91	0.91	0.92	0.92	0.91	0.91	091	0.92

Notes: The dependent variable in all columns is the log of the average unit value at the firm, product, destination country and year level. In columns (1)-(4) the destination is any country, and in colums (5)-(8) the destination is any country outside the affiliate's network.

*** ; ** ; * significant at the 1%, 5% and 10% level respectively

Table 4: Regressions on establishment characteristics

Comparison with all firms						
	Labor		Share of skilled workers		Productivity	
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy vertical affiliate	0.8437***	0.8537***	0.1844***	0.1823***	0.3788***	0.3693***
	(0.0322)	(0.0324)	(0.0089)	(0.0089)	(0.0315)	(0.0316)
Observations	65178	65178	65178	65178	57680	57680
R^2	0.15	0.16	0.11	0.13	0.04	0.07
Comparison with exporters						
	Labor		Share of skilled workers		Productivity	
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy vertical affiliate	0.3726***	0.3837***	0.1477***	0.1478***	0.2687***	0.2652***
	(0.0385)	(0.0397)	(0.0088)	(0.0089)	(0.0330)	(0.0335)
Observations	18134	18134	18134	18134	16343	16343
R^2	0.17	0.19	0.21	0.25	0.09	0.13
Comparison with non-exporters						
	Labor		Share of skilled workers		Productivity	
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy vertical affiliate	1.1886***	1.2001***	0.1800***	0.1772***	0.4355***	0.4263***
	(0.0277)	(0.0279)	(0.0095)	(0.0095)	(0.0329)	(0.0331)
Observations	48201	48201	48201	48201	42343	42343
R^2	0.13	0.15	0.11	0.13	0.05	0.08
Sector fixed effect	yes	no	yes	no	yes	no
Year fixed effect	yes	no	yes	no	yes	no
Sector-year fixed effect	no	yes	no	yes	no	yes

Notes: The dependent variable in columns (1) and (2) is the log of the the establishment's labor force; the dependent variable in columns (3) and (4) is the share of skilled workers in total workers; the dependent variable in columns (5) and (6) is a measure of total factor productivity based on the multifactor superlative index number. the sector is defined at the 4-digit ISIC rev3 level.

*** ; ** ; * significant at the 1%, 5% and 10% level respectively

Table 5: Regressions on exports and number of products, controlling for firm characteristics

	To all countries				To countries outside the network			
	Exports		Number of products		Exports		Number of products	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy vertical affiliate	0.8751***	0.8536***	0.1680***	0.1561***	0.5591***	0.5285***	-0.0439	-0.0530
	(0.1042)	(0.1081)	(0.0448)	(0.0461)	(0.1065)	(0.1103)	(0.0457)	(0.0470)
Labor	1.2287***	1.2256***	0.4485***	0.4544***	1.2261***	1.2242***	0.4451***	0.4510***
	(0.0234)	(0.0244)	(0.0101)	(0.0104)	(0.0234)	(0.0244)	(0.0101)	(0.0104)
Productivity	0.3518***	0.3657***	0.1904***	0.2121***	0.3501***	0.3626***	0.1878***	0.2078***
	(0.0322)	(0.0341)	(0.0138)	(0.0146)	(0.0322)	(0.0342)	(0.0138)	(0.0146)
Share of skilled labor	1.0483***	1.1259***	0.3078***	0.3116***	1.0274***	1.1055***	0.2911***	0.2912***
	(0.1014)	(0.1071)	(0.0436)	(0.0457)	(0.1014)	(0.1071)	(0.0436)	(0.0456)
Sector fixed effect	yes	no	yes	no	yes	no	yes	no
Year fixed effect	yes	no	yes	no	yes	no	yes	no
Sector-year fixed effect	no	yes	no	yes	no	yes	no	yes
Observations	8000	8000	8002	8002	7975	7975	7977	7977
R^2	0.49	0.52	0.32	0.37	0.48	0.52	0.31	0.37

Notes: The dependent variable in columns (1),(2),(5) and (6) is the log of exports at the firm, sector and year level; the dependent variable in columns (3),(4),(7) and (8) is the log of the number of products at the firm, sector and year level. In columns (1)-(4) the destination is any country, and in colums (5)-(8) the destination is any country outside the affiliate's network. Sector is defined at the 4-digit ISIC rev3 level.

*** ; ** ; * significant at the 1%, 5% and 10% level respectively

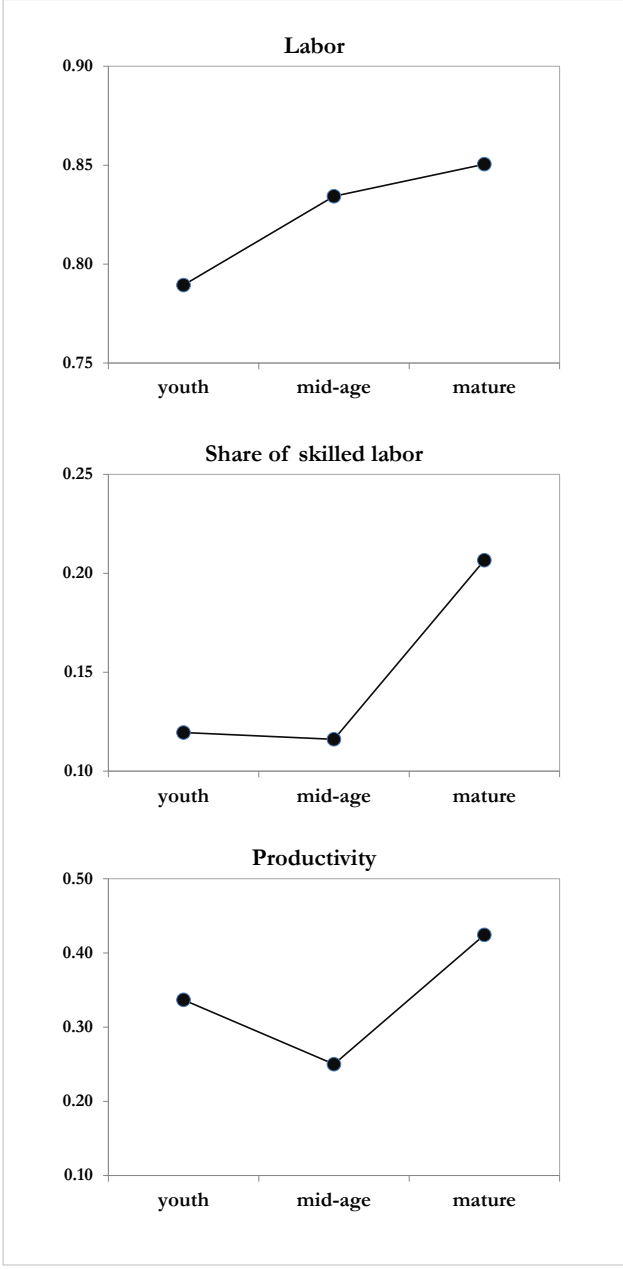
Table 6: Regressions on unit values, controlling for firm characteristics

	To all countries				To countries outside the network			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy vertical affiliate	0.0670***	0.0579***	0.0777***	0.0785***	0.0383***	0.0568***	0.0579***	0.0932***
	(0.0125)	(0.0134)	(0.0117)	(0.0142)	(0.0145)	(0.0157)	(0.0135)	(0.0162)
Labor	0.0271***	0.0203***	0.0438***	0.0389***	0.0258***	0.0209***	0.0435***	0.0407***
	(0.0125)	(0.0125)	(0.0029)	(0.0036)	(0.0031)	(0.0034)	(0.0030)	(0.0036)
Productivity	0.0274***	0.0239***	0.0326***	0.0289***	0.0268***	0.0242***	0.0321***	0.0292***
	(0.0031)	(0.0035)	(0.0034)	(0.0039)	(0.0035)	(0.0036)	(0.0034)	(0.0039)
Share of skilled labor	0.0811***	0.0242*	0.1026***	0.0252*	0.0880***	0.0349***	0.1118***	0.0379**
	(0.0035)	(0.0131)	(0.0127)	(0.0035)	(0.0129)	(0.0133)	(0.0128)	(0.0152)
Product fixed effect	yes	no	no	no	yes	no	no	no
Country fixed effect	yes	no	no	no	yes	no	no	no
Year fixed effect	yes	yes	no	no	yes	yes	no	no
Product-country fixed effect	no	yes	no	no	no	yes	no	no
Product-year fixed effect	no	no	yes	no	no	no	yes	no
Country-year fixed effect	no	no	yes	no	no	no	yes	no
Product-country-year fixed effect	no	no	no	yes	no	no	no	yes
Observations	186723	186723	186723	186723	181708	181708	181708	181708
R^2	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92

Notes: The dependent variable in all columns is the log of the average unit value at the firm, product, destination country and year level. In columns (1)-(4) the destination is any country, and in colums (5)-(8) the destination is any country outside the affiliate's network.

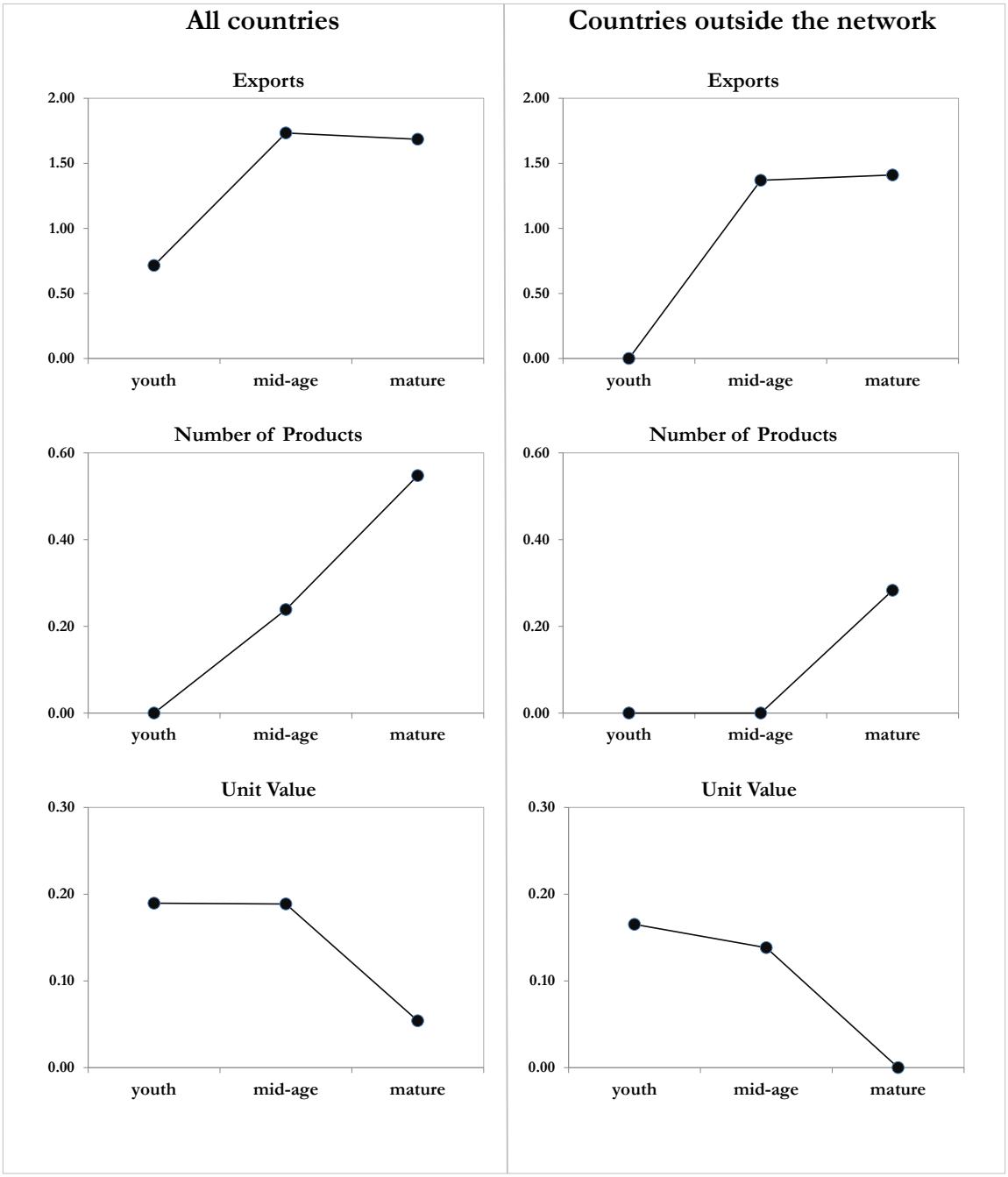
*** ; ** ; * significant at the 1%, 5% and 10% level respectively

Figure 1: Estimated coefficients for the vertical affiliate dummies across cohorts, firm characteristics



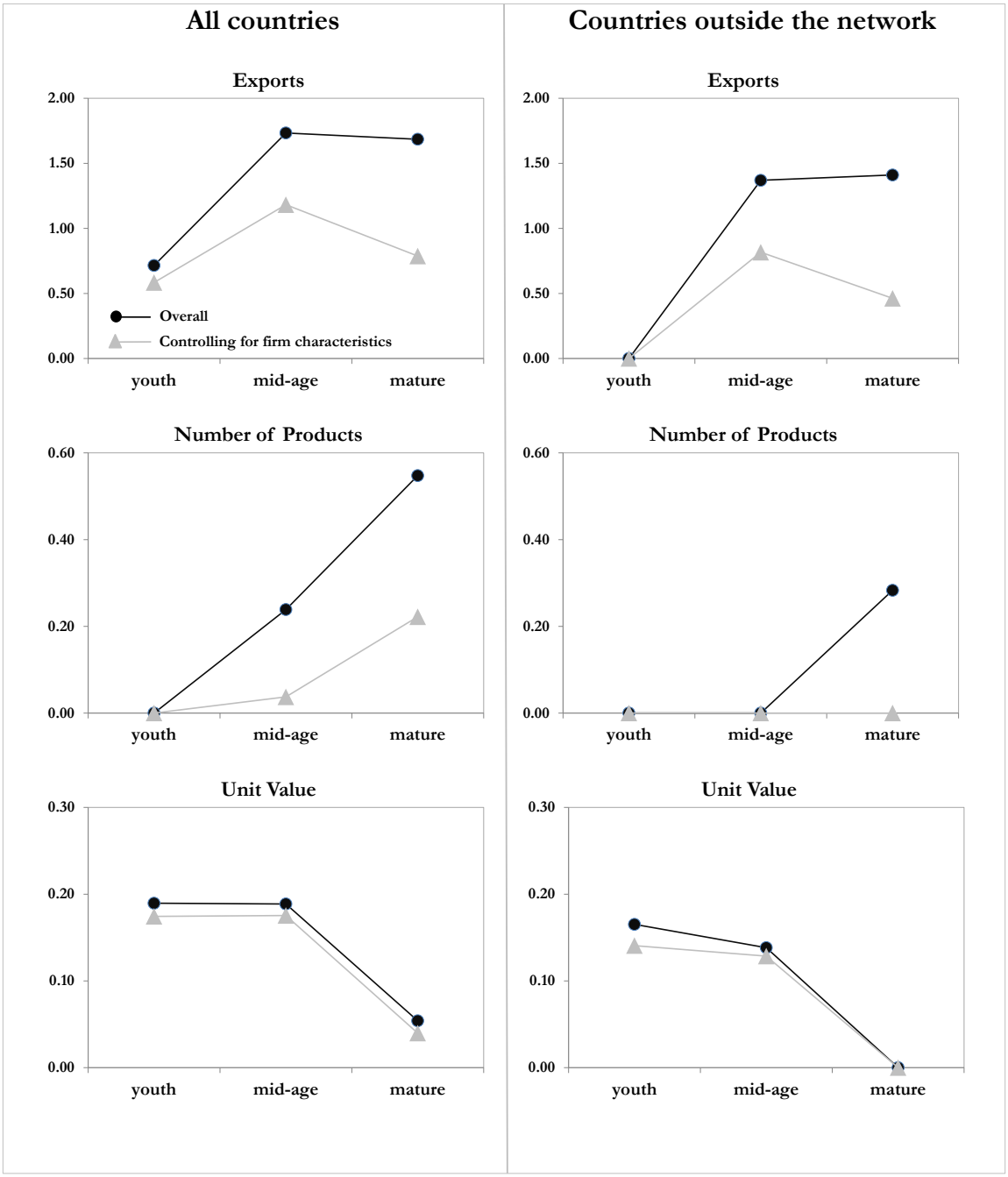
Note: the graphs present the point estimates of β_1 , β_2 and β_3 in equation (3) when the dependent variables are the log of labor, the log of the share of skilled labor and the log of productivity

Figure 2: Estimated coefficients for the vertical affiliate dummies across cohorts, export variables



Note: the graphs present the point estimates of β_1 , β_2 and β_3 in equation (3) when the dependent variables are the log of total exports, the log of the number of products exported and the log of unit values. The three graphs in the first column depict the results when all the exports of the foreign affiliate are considered while the three graphs of the second column present the results when only the exports of the affiliate to the countries outside its network are employed

Figure 3: Estimated coefficients for the vertical affiliate dummies across cohorts and controlling for firm characteristics, export variables



Note: the graphs present the point estimates of β_1 , β_2 and β_3 in equation (3) when the dependent variables are the log of total exports, the log of the number of products exported and the log of unit values. The point estimates when no firm characteristics are controlled for are presented in dark circles while the point estimates after controlling for firm characteristics are presented in light triangles. The three graphs in the first column depict the results when all the exports of the foreign affiliate are considered while the three graphs of the second column present the results when only the exports of the affiliate to the countries outside its network are employed